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SUMMARY OF MONITORING PROGRAM

UNIFIRST CORPORATION
WOBURN, MASSACHUSETTS

ERT Document P-B961-800

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1. INTRODUCTION

In accordance with paragraphs 3 and 4 and Appendix B of the consent order entered in In the matter of Interstate Uniform Services, Corp., EPA Docket No. 83-1006 (Consent Order), Environmental Research & Technology, Inc. (ERT) has completed a monitoring program (Monitoring Program) for the UniFirst Corporation (UniFirst) site (site) in Woburn, Massachusetts. The Monitoring Program was developed by ERT and Goodwin, Proctor and Hoar, legal counsel for UniFirst, and approved by the United States Environmental Protection Agency (EPA). The objective of the Monitoring Program was to investigate the presence, if any, of tetrachloroethylene in ground water upgradient from the site.

2. MONITORING PROGRAM

The Monitoring Program entailed a phased approach to the installation of ground-water monitoring wells at three (3) locations hydraulically upgradient from the site. Figure 1 displays the potentiometric surface elevations computed from ground-water level measurements made by ERT and NUS Corp. Table 1 displays the water-level measurement data and the vertical survey control information from which the piezometric surface elevations have been computed. An NUS Corp. and/or EPA representative was present at all times during the well drilling, ground-water sampling and ground-water level measurement work.

Drilling for monitoring well installation at location UC-1 was performed from 18 to 23 November 1983. The location of UC-1 (Figure 1) was moved from within the dividing median of the Massachusetts Department of Public Works (DPW) exit ramp, as proposed by the Monitoring Program, northerly to the baseline right-of-way for the same ramp. The exit ramp, as shown in Figure 1, connects Washington Street and Route 128 north. UC-1 was relocated in order to increase worker safety during installation and to reduce subsurface exploration footage by drilling at the toe of the slope adjacent to the ramp fill material.

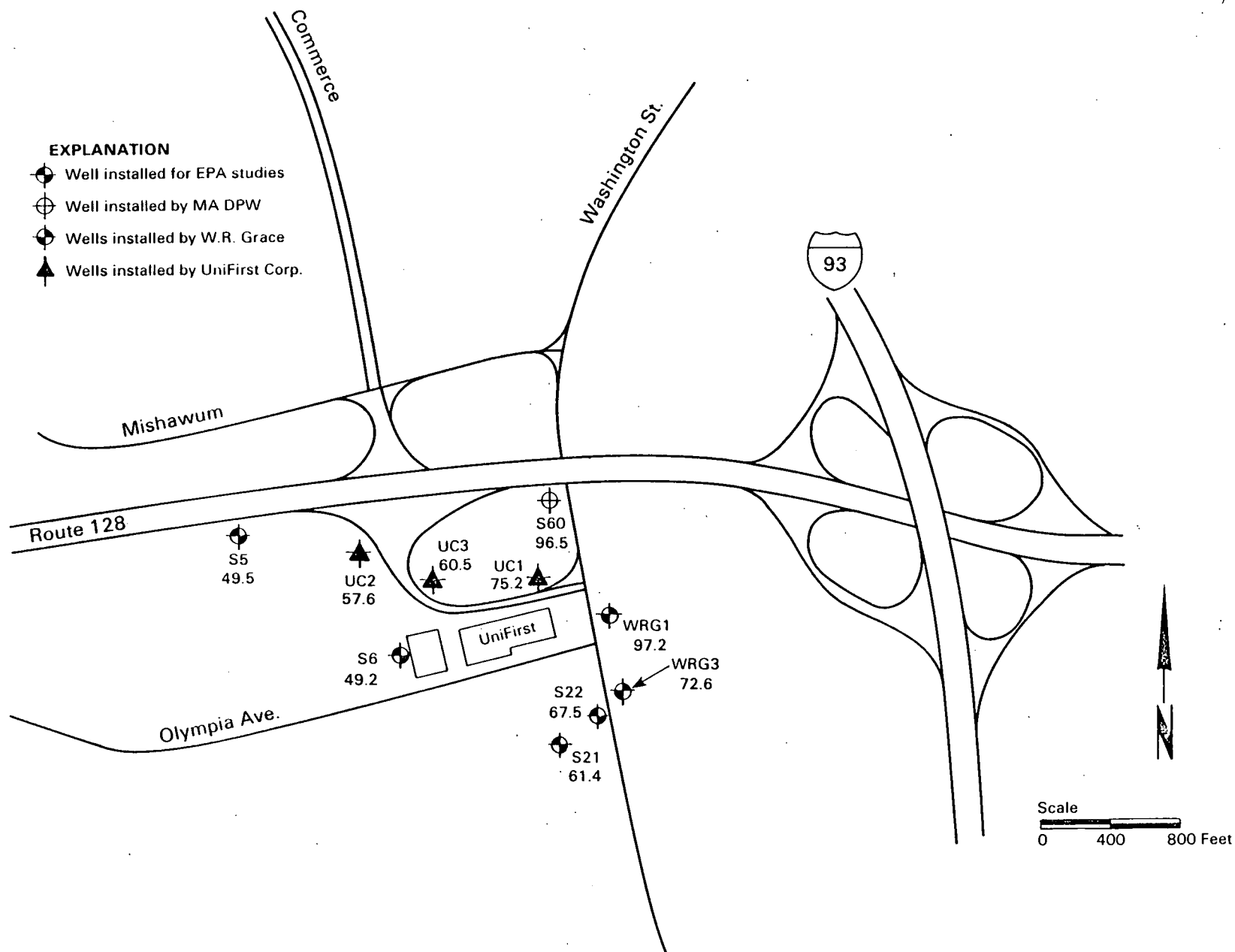


Figure 1 Site Location Map
Potentiometric Surface Elevations - as Measured July 18, 1984

TABLE 1
WATER LEVEL MEASUREMENT DATA
UNIFIRST CORPORATION - WOBURN MASSACHUSETTS
JULY 18, 1984

Well No.	Ground Surface Elev. ¹ (ft)	Top of Protective Casing Elev. ¹ (ft)	Height of Casing Above Gnd. Surface (ft)	Water Level Below Top of Protective Casing (ft)	Piezometric Surface Elev. ¹ (ft)
UC-1	-	88.40	-	13.20	75.2
UC-2C	-	63.40	-	6.14	57.6
UC-3C	-	67.20	-	6.72	60.5
S-5	52	-	1.60	4.09	49.5
S-6	56	-	2.95	9.77	49.2
S-60	-	122.40	-	25.91	96.5
S-22	-	85.48	-	17.95*	67.5
S-21	-	79.88	-	18.50*	61.4
WRG-3S	-	94.33	-	21.77	72.6
WRG-1S	-	100.33	-	8.29	97.2

¹All elevations represent feet above NGVD.

*Measurements obtained from D. Delaney (U.S. EPA-Region I). NUS Corp. had collected samples of water from these wells prior to measurement of the piezometric surface by ERT (7-18-84). ERT used measurements that NUS had taken prior to purging the wells.

Bedrock was encountered at 11.7 feet below the ground surface at UC-1. Only one of the originally planned three monitoring wells (UC-1) was installed at this location because bedrock was found close to the ground surface and the saturated thickness of unconsolidated deposits was approximately one foot. The screened interval of UC-1 (see boring logs in Appendix) intercepts ground water flowing at the top of bedrock and in the upper 15 feet of bedrock. Ground-water level measurements indicate that the potentiometric surface rises above the top of bedrock at this location during seasonal high ground water.

The subsequent monitoring well installations at UC-2 and UC-3 in March and April of 1984 were constructed as three (3) well clusters as specified in Appendix B of the Consent Order. Some of the UniFirst monitoring wells were constructed with screened intervals greater than the ten (10) feet specified in Appendix B. The screen lengths were selected such that each well cluster would intercept a large portion of the total depth of the saturated thickness in the unconsolidated deposits and upper bedrock. Screen lengths were also increased to enhance the recharge of monitoring wells screened in the gray till.

Schedule 40 PVC pipe was substituted for the specified schedule 80 pipe for monitoring-well riser pipe and well screens. This change does not affect the integrity of the monitoring wells or the analytical results of ground-water samples taken from these wells.

A security program was developed by EPA and ERT to protect partially constructed monitoring wells from vandalism during drilling operations. The program consisted of collecting, from the borehole, a soil (SS) or bailed water (BS) sample, depending upon whether the boring had been advanced below ground water, at the start and finish of each day of drilling. In addition, the drilling water (DW) was sampled at the start and finish of each day and resampled if drilling water tanks required refilling during the course of the work day. Tables 2, 3, 4 and 5 provide sample collection information and chemical analytical results for samples obtained during the installation of the UniFirst monitoring wells. At the end of each day of drilling, open boreholes or unfinished monitoring wells were secured by threading the drill-rig chuck rod into a casing flush

TABLE 2
SAMPLE SUMMARY
MONITORING WELL INSTALLATION UC-1
UNIFIRST CORPORATION - WOBURN, MASSACHUSETTS

<u>Date</u>	<u>Sample No.</u>	<u>Sample Type</u>	<u>Notes</u>
11-18-83	SS-1	Soil ¹	Physical characterization. 0-1.5 feet below ground surface. See boring log in Appendix.
11-18-83	AF-1	Soil	Collected sample in VOA vial for headspace analyses of soil at 4 ft below ground surface. Sample obtained from auger flight extracted from bore hole. See Table 3 for analytical results.
11-18-83	HNU-1	Air ²	700 units ³ - representing the probable presence of dust material resulting from friction caused by auger teeth grinding rock. After 5 minute period reading = 0.4 units, equivalent to background ambient air conditions.
11-21-83	HNU-2	Air	Starting measurement = 0.35 units. Equivalent to background ambient air.
11-21-83	DW-1	Water	Water introduced to borehole for drilling operation. Sample obtained from disconnected water swivel. Collected in VOA vial for subsequent analyses. See Table 3.
11-21-83	SS-2	Soil ¹	Physical characterization. 10-11 feet below ground surface. See boring log in Appendix.
11-21-83	HNU-3	Air	Closing measurement = 0.4 units. Equivalent to background.
11-22-83	HNU-4	Air	Starting measurement = 0.75 units. Background = 0.4 units.
11-22-83	DW-2	Water	Explanation same as Sample No. DW-1.
11-22-83	BS-1	Water	Bailed sample obtained from borehole cased to bedrock. See Table 2 for analytical results.

TABLE 2 (Continued)

11-22-83	SS-1 (duplicate)	Soil ¹	Collected sample in VOA vial for headspace analyses from 0-1.5 feet below ground surface. See Table 3 for analytical results.
11-23-83	HNU-5	Air	Starting measurement = 3.2 units. Background = 0.25 units.
11-23-83	BS-2	Water	Bailed sample from cased borehole to establish start-of-day conditions. See Table 3 for analytical results.
11-23-83	DW-3	Water	Explanation same as Sample No. DW-1.
11-23-83	FB-1	Sand/ Water	Mixture of Ottawa Sand and deionized water placed in VOA vial. See Table 3 for analytical results.
11-23-83	BS-3	Water	Bailed sample from newly installed 2-inch diameter PVC monitoring well. Establishes finished conditions prior to purging and securing well. See Table 3 for analytical results.
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12-08-83	BS-4	Water	Sample of water standing in well casing. Second bail removed after starting to purge well. See Table 6 for analytical results.
12-08-83	BS-5	Water	Collected after withdrawing approximately 15 gallons of ground water from well. See Table 6.
12-08-83	BS-5 (duplicate)	Water	Same as BS-5.
12-08-83	FB-2	Water	Obtained from clean bailer which was filled with deionized water. See Table 6 for analytical results.

NOTES

¹Collected, using standard split-spoon soil sampler driven by a 140 lb hammer through 30-inch falls.

²As measured using a portable HNU Model PI 101 total gaseous photoionization analyzer.

³"Units" indicate measurement of total hydrocarbons. Not indicative of specific chemical compounds.

TABLE 3
ANALYTICAL DATA
MONITORING WELL INSTALLATION UC-1
UNIFIRST CORPORATION-WOBURN, MASSACHUSETTS

Sample No.	AF-1 (µg/g)	DW-1	DW-2	BS-1	SS-1 (dup. µg/g)	BS-2	DW-3	FB-1	BS-3
Parameter									
chloromethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
dichlorodifluoromethane	NA	BDL	BDL	BDL	NA	BDL	BDL	BDL	BDL
bromomethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
vinyl chloride	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
chloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
methylene chloride	BDL	BDL	BDL	14	BDL	BDL	22	35	BDL
acrolein*	NA	BDL	BDL	BDL	NA	BDL	BDL	BDL	BDL
acrylonitrile*	NA	BDL	BDL	BDL	NA	BDL	BDL	BDL	BDL
trichlorofluoromethane	BDL	BDL	BDL	16	0.28	BDL	35	42	BDL
1,1-dichloroethylene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1-dichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
trans-1,2-dichloroethylene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
chloroform	BDL	14	15	BDL	BDL	BDL	BDL	BDL	BDL
1,2-dichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-trichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
carbon tetrachloride	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
bromodichloromethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
bis-chloromethyl ether	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-dichloropropane	0.28	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
trans-1,3-dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
trichloroethylene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
dibromochloromethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
cis-1,3-dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,2-trichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
benzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

TABLE 3 (Continued)

Sample No.	AF-1 ($\mu\text{g/g}$)	DW-1	DW-2	BS-1	SS-1 (dup. $\mu\text{g/g}$)	BS-2	DW-3	FB-1	BS-3
<u>Parameter</u>									
2-chloroethylvinyl ether	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
bromoform	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
tetrachloroethylene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,2,2-tetrachloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
toluene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
chlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ethylbenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limit = < .1 $\mu\text{g/g}$ in soil samples, and <10 $\mu\text{g/l}$ in water samples

*For these samples BDL = < 100 $\mu\text{g/l}$

NA = Not Analyzed.

Note: All concentrations in micrograms per liter ($\mu\text{g/l}$) unless otherwise noted, in accordance with EPA analytical protocol - Method 624.

TABLE 4
SUMMARY OF SAMPLES COLLECTED
INSTALLATION OF MONITORING WELL CLUSTER UC-2
UNIFIRST CORPORATION-WOBURN, MA

<u>Date</u>	<u>Sample Designation</u>	<u>Boring No.</u>	<u>Chemical Analyses (µg/l)</u>	
			<u>Chloroform</u>	<u>1,1,2,2-Tetrachloroethane</u>
3-13-84	SS-1 ¹ (0-1.5')	UC-2A	-	-
	DW-1 ² *		17	BDL
	WW-1 ³ *		11	BDL
	SS-9 (34'-35.5')		-	-
	DW-2 *		17	BDL
3-14-84	BS-1 ⁴ *		BDL ⁵	BDL
	DW-3		-	-
	SS-15		-	-
	BS-2 *		13	BDL
	DW-4		-	-
3-15-84	BS-3 *		12	11
	DW-5		-	-
	DW-6		-	-
3-16-84	BS-4 *		10	BDL
	DW-7		-	-
	BS-5 *		BDL	BDL
	SS-1(0-1.5')		-	-
	DW-8		-	-
3-20-84	BS-6 *	UC-2A	13	BDL
	DW-9	UC-2B	-	-
	BS-7 *		BDL	BDL
	BS-8 *		BDL	BDL
	OS-1		-	-
3-21-84	BS-9 *		BDL	BDL
	BS-10 *		BDL	BDL
	DW-10	UC-2B	-	-
	BS-11 *		BDL	BDL
3-22-84	DW-11		-	-
	BS-12 *		BDL	BDL
	BS-13 *		BDL	BDL
	DW-12		-	-
	DW-13		-	-
3-23-84	DW-14		-	-
	BS-14 *		13	BDL
	BS-15 *	UC-2A	17	BDL
	DW-15		-	-
	DW-16		-	-
	BS-16 *	UC-2C	BDL	BDL
	BS-17 *		BDL	BDL

TABLE 4 (Continued)

<u>Date</u>	<u>Sample Designation</u>		<u>Boring No.</u>	<u>Chemical Analyses (µg/l)</u>	
				<u>Chloroform</u>	<u>1,1,2,2-Tetrachloroethane</u>
3-26-84	BS-18	*	UC-2C	BDL	BDL
	DW-17			-	-
	BS-19	*		14	BDL
	DW-18			-	-

¹ Soil sample collected from split spoon. Footage range indicates sampling interval below ground surface.

² Water used as drilling fluid. Drilling water (DW) collected from chuck rod on drilling rig. DW samples were stored pending analyses of corresponding bailed samples (i.e., BS-).

³ Wash water returning from of borehole with cuttings from drilling.

⁴ Bailed sample from borehole as collected using stainless steel top-loading bailer provided by NUS Corp. (US EPA Contractor). All "BS-" samples collected from the second, and at times, third bailer of water withdrawn from borehole except for sample BS-16-UC-2A. This sample was collected using a thin wall Teflon® bailer provided by ERT after removal of one well volume by bailing

⁵ BDL = Below Detection Limit = <10 µg/l in accordance with EPA analytical protocol - Method 624.

*Indicates samples which were analyzed for volatile organics.

TABLE 5
SUMMARY OF WATER SAMPLES COLLECTED
INSTALLATION OF MONITORING WELL CLUSTER UC-3
UNIFIRST CORP. WOBURN, MA

Date	Sample Designation	Boring No.	Chemical Analyses (µg/l)	
			Chloroform	1,1,2,2-Tetrachloroethane
3-27-84	DW-1 ¹	UC-3A	-	-
	BS-1 ² *		BDL ³	BDL
	DW-2		-	-
3-28-84	BS-2 *		12	BDL
	DW-3		-	-
	DW-4		-	-
3-30-84	BS-3 *		BDL	BDL
	DW-5		-	-
	BS-4 *		BDL	BDL
4-2-84	DW-6		-	-
	BS-5 *		10	BDL
	DW-7		-	-
4-3-84	BS-6 *		BDL	BDL
	BS-7 *		BDL	BDL
	DW-8		-	-
4-4-84	DW-9	UC-3B	-	-
	BS-8 *	UC-3A	BDL	BDL
	BS-9 *	UC-3B	BDL	BDL
4-6-84	DW-10		-	-
	BS-10 *		BDL	BDL
	DW-11		-	-
4-6-84	BS-11 *	UC-3C	15	BDL
	BS-12 *		15	BDL
	DW-12		-	-
4-6-84	BS-13 *		BDL	BDL
	DW-13		-	-
	BS-14 *		BDL	BDL
	DW-14		-	-

¹Water used as drilling fluid. Drilling water (DW) collected from chuck rod on drilling rig. DW samples were stored pending analyses of corresponding bailed samples (i.e. BS-).

²Bailed sample from borehole as collected using stainless steel top-loading bailer provided by NUS Corp. (US EPA Contractor). All "BS-" samples collected from the second and at times third bailer of water withdrawn from borehole except for sample BS-8-UC-3A. This sample was collected using a thin wall Teflon® bailer provided by ERT after removal of 4 well volumes by bailing.

³BDL = Below Detection Limit = < 10µg/l in accordance with EPA analytical protocol-Method 624.

*Indicates samples which were analyzed for volatile organics.

plug. In some cases a 300 lb hammer was placed onto a drive head which was previously threaded into the borehole casing.

During the installation of wells at location UC-2 and UC-3, ERT did not directly analyze samples of the drilling water (DW), but analyzed the corresponding bailed samples to first ascertain whether tetrachloroethylene was present in the borehole water. As this compound was not detected in bailed samples, it was assumed that tetrachloroethylene was not introduced to the boreholes via drilling water. Therefore, the "DW" designated samples were not analyzed. Tables 3, 4 and 5 show that no tetrachloroethylene was detected in any of the samples collected during well installation.

Tables 4 and 5 provide data for only two (2) of the thirty (30) volatile organic compounds for which the bailed samples (BS) were analyzed. The remaining twenty-eight (28) parameters are not shown in Tables 4 and 5 because these twenty-eight (28) compounds were not identified above the detection limit of 10 µg/l.

Ground-water samples were obtained from all new monitoring wells within approximately one month of completion. Table 6 contains the analytical results for the ground-water samples obtained from each of the seven (7) UniFirst wells.

3. DATA INTERPRETATION

The observed water table elevations indicated in Figure 1 show that the potentiometric surface decreases towards the south and west. From this map, it can be seen that ground-water is generally directed from northeast to southwest.

As shown in Table 6, no tetrachloroethylene was detected in the ground-water samples collected from the UniFirst wells at locations UC-1, 2 and 3.

Two other observations should be made about the results set out in Tables 3, 4, 5 and 6. The drilling water (DW) samples manifest chloroform. This compound is commonly detected in municipal water supplies as a result of chlorination. The drilling water was obtained directly from an outside tap at the front of the UniFirst-Woburn

TABLE 6

ANALYTICAL DATA

UNIFIRST CORPORATION - WOBURN, MASSACHUSETTS

GROUND-WATER SAMPLES

Well No. UC	1	1	1	1	2A	2A	2B	2C	3A	3B	3C	FB
Sample No.	BS-4	BS-5	BS-5(dup.)	FB-1	-	dup.	-	-	-	-	-	-
Sample Date	12-08-83	12-08-83	12-08-83	12-08-83	05-01-84	05-01-84	05-01-84	05-01-84	05-01-84	05-01-84	05-01-84	05-01-84
Parameter												
chloromethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
dichlorodifluoromethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
bromomethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
vinyl chloride	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
chloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
methylene chloride	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
acrolein*	BDL	BDL	BDL	BDL	NA	NA	NA	NA	NA	NA	NA	NA
acrylonitrile*	BDL	BDL	BDL	BDL	NA	NA	NA	NA	NA	NA	NA	NA
trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1-dichloroethylene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1-dichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
trans-1,2-dichloroethylene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
chloroform	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	22
1,2-dichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-trichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
carbon tetrachloride	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
bromodichloromethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
bis-chloromethyl ether	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-dichloropropane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
trans-1,3-dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
trichloroethylene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	13
dibromochloromethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
cis-1,3-dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,2-trichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
benzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limit = <10µg/L in accordance with EPA analytical protocol -- Method 624

*For these samples BDL = < 100 µg/L

NA = Not analyzed.

Note: All concentrations in micrograms per liter (µg/L).

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TABLE 6 (Continued)

Well No. UC	1	1	1	1	2A	2A	2B	2C	3A	3B	3C	FB
Sample No.	BS-4	BS-5	BS-5	FB-1	-	dup.	-	-	-	-	-	-
Sample Date	12-08-83	12-08-83	12-08-83	12-08-83	05-01-84	05-01-84	05-01-84	05-01-84	05-01-84	05-01-84	05-01-84	05-01-84
Parameter												
2-chloroethylvinyl ether	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
bromoform	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
tetrachloroethylene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,2,2-tetrachloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
toluene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
chlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ethylbenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limit = <10 µg/l in accordance with EPA analytical protocol - Method 624.

*For these samples BDL = < 100 µg/l

NA = Not Analyzed.

Note: All concentrations in micrograms per liter (µg/l).

facility. During the installation of the monitoring wells drilling water was introduced to boreholes which would then produce bailed samples of similiar chemical quality. Methylene chloride and trichlorofluoromethane, also present in detectable levels in Tables 3 and 6, are solvents used frequently for chemical extractions in laboratories and are most probably detected in samples because of such interference.

APPENDIX
BORING LOG

Project B961 Site Woburn, MA. **BORING** UC-1 Sh 1 of 1
 Date Started 11-18-83 Completed 11-23-83 Ground Elevation _____
 Total Depth 26.5 ft. Location _____ Logged by C. Carleo/J. Lawson
 Casing I.D. 4 in and 3 in Contractor Con-Tec., Inc.
 Remarks Split spoon advanced in 14 in. falls of 300 lb. hammer

Elev. Feet	Depth Feet	Sample				Graphic Log	Sample Description	Equipment Installed Concrete Surface Seal
		Type & Number	Blows per 6 in.	Depth Range	Rec.			
		SS-1	2-5-14	0.0-1.5	0.9	Fill	0.0-0.5 Brown, fine sand, some silt.	
							.5-1.5 Gray course to fine sand, trace gravel	
	5					Till	Boulder at 4.5 ft. move rig 6 ft. west boulder at 3-4 ft.	
			50-0.1	5.0-5.1	0			
	10	SS-2	45-75	10.0-11.0	0		10.0-11.0 Brown, coarse to fine sand, little silt, trace gravel. Pulverized rock recovered at top of sample and weathered rock recovered in shoe. Roller bit used to drill through boulders or fractured and weathered bedrock 11.0-14.5.	3:1 Bentonite-Cement Seal
	15	NX-1		14.5 - 19.3	4.4			
	20	NX-2		19.3 - 26.5	7.1		Top of Rock 11.7 14.5 - 26.5 Pink, coarse grained granite, moderately fractured, fracture surface smooth and planar to wavy, coated with iron and manganese oxide, open silt/clay filled joint at 26.5	Ottawa Sand Packing
	25							
		Bottom of Boring at 26.5						
		Notes: 1. Lost drill water at 15.0 ft. Never regained 2. Ground water at 11.85 ft. 11/23/83						

*4 inch steel guard pipe with locking cap installed at surface

ERT

ENVIRONMENTAL RESEARCH & TECHNOLOGY, INC.

Riser - 2 in. ID Sch. 40 PVC threaded coupling riser 2 in. ID Sch. 40 0.01 inch slot.

BORING LOG

Project Unifirst Corp. Site Woburn, MA. BORING UC-2A Sh 1 of 2
 Date Started 3/13/84 Completed 3/21/84 Ground Elevation 61.3
 Total Depth 89' Location Charette Corp. Property Logged by C. Carleo/J. Lawson
 Casing I.D. PW to 18', HW to 71' Contractor Guild Drilling Co. Inc.
 Equipment Installed: 0'-71', 2" sch. 40 PVC riser pipe, 71'-89', 2" sch. 40 PVC 0.010"
slotted screen. Surface seal concrete 0-3', Bentonite Seal 3'-69', Sand Packing 69'-89'.
 Remarks: Elevation at top of protective casing = 63.2 ft above NGVD (with cap off)

SAMPLE						Strata Change Depth	Sample Description	HNU Response (PPM)
Depth Feet	Type & Number	Blows per 6 in.	Depth Range	Rec.	U.S.C.S.			
0	SS-1	002/02/03	0-1.5	12"		2.5'	Brown sandy & loamy TOPSOIL trace fine to coarse (F-6) gravel	
5	SS-2	009/15/17	4-5.5	6"		7'	Dark brown F-C SAND some F-C gravel, little silt	
10	SS-3	013/11/15	9-10.5	9"		8'	Brown PEAT	
						10'	Light brown F-6 SAND, little F-C gravel, trace silt	
						11.5'	Light brown fine SAND, some silt	
15	SS-4	015/15/13	14-15.5	2"				
	SS-5	007/09/15	15.5-17.0	6"		18'	Brown fine to coarse SAND and Gravel, trace of silt	
20	SS-6	030/55/67	19.0-20.5	14"			Gray sandy TILL	
25	SS-7	053/36/30 (300# wt.)	24.0-25.5	9"				
30	SS-8	42/121/46 (300# wt.)	29.0-30.5	16"				
35	SS-9	065/54/54 (300# wt.)	34.0-35.5	12"				
40	SS-10	024/67/69	39-40-25	13"			Gray TILL	

ERT BORING LOG

Project Unifirst Corp. Site Woburn, MA BORING UC-2A Sh 2 of 2

Depth Feet	Type & Number	SAMPLE		Depth Range	Rec.	U.S.C.S.	Strata Change Depth	Sample Description	HNU Response (PPM)
		Blows per 6 in.							
45	SS-11	031/33/63 (300# wt.)		44.0-45.5	14"			Gray TILL	
50	SS-12	024/36/29 (300# wt.)		49.0-50.5	14"				
55	SS-13	031/42/60 (300# wt.)		54.0-55.5	11"				
60	SS-14	026/25/14 (300# wt.)		59.0-60.5	12"				
65	SS-15	100/113/80 80-3" (300 # wt.)		64-65.25	15"				
70	SS-16	035/037/93 (300# wt.)		69.0'-70.5	16"		71'	Top of Rock Drilled ahead to 74' with 3" roller bit.	
75	NX-1			74.0-77.5	3.4'			Gray, medium grained GNEISS; joints 20° to core axis; joint faces wavy, planar, fresh, trace of iron oxide staining; fracture frequency ~6 in.	
	NX-2			77.5-79.0	1.3'				
80	NX-3			79.0-84.0	5.0'				
85	NX-4			84.0-89.0	4.8'			Gray, medium grained GNEISS; same as above	
90							89'	Bottom of Borehole	

ERT BORING LOG

Project Unifirst Corp. Site Woburn, MA BORING UC-2B Sh 1 of 1
 Date Started 3/16/84 Completed 3/23/84 Ground Elevation 61.2
 Total Depth 55' Location Charrette Corp. Property Logged by C. Carleo/J. Lawson
 Casing I.D. PW to 14', HW to 55' Contractor Guild Drilling Co. Inc.
 Equipment Installed: 0'-40', 2" sch. 40 PVC riser pipe, 40'-55', 2" sch. 40 PVC 0.010" slotted
screen. Surface seal concrete 0-3, Bentonite Seal 3'-38', Ottawa Sand Parking 38'-55'
 Remarks Elevation at top of protective casing = 63.0 ft. above NGVD (with cap off)

SAMPLE								HNU Response (PPM)
Depth Feet	Type & Number	Blows per 6 in.	Depth Range	Rec.	U.S.C.S.	Strata Change Depth	Sample Description	
0								
5								
10								
15								
20								
25								
30								
35								
40								

NO SOIL SAMPLES
COLLECTED

ERT BORING LOG

Project Unifirst Corp. Site Woburn, MA BORING UC-2C Sh 1 of 1
 Date Started 3/23/84 Completed 3/26/84 Ground Elevation 61.3
 Total Depth 20' Location Charrette Corp. Property Logged by C. Carleo/J. Lawson
 Casing I.D. HW 0 to 20' Contractor Guild Drilling Co. Inc.
 Equipment Installed: 0'-10' sch. 40 PVC riser pipe, 10-20' sch. 40 PVC 0.010" slotted screen.
Surface seal concrete 0'-3', bentonite seal 3'-7.8', Ottawa sand packing 7.8'-20'
 Remarks Elevation at top of protective casing = 63.4 ft above NGVD (with cap off)

SAMPLE							
Depth Feet	Type & Number	Blows per 6 in.	Depth Range	Rec.	U.S.C.S.	Strata Change Depth	HNU Response (PPM)
0							
5							
10							
15							
20							
25							
30							
35							
40							

NO SOIL SAMPLES
COLLECTED

ERT BORING LOG

Project Unifirst Corp. Site Woburn, MA BORING UC-3A Sh 1 of 3
 Date Started 3/27/84 Completed 4/2/84 Ground Elevation 66.6
 Total Depth 62' Location MASS. DPW R.O.W. Logged by C. Carleo/J. Lawson
 Casing I.D. HW to 55' Contractor Guild Drilling Co. Inc.
 Equipment Installed: 0-47', 2" sch. 40 PVC riser pipe, 47'-63', 2" sch 40 PVC 0.010" slotted
screen. Surface seal concrete 0-3', Bentonite seal 3'-44.7', Ottawa sand packing 44.7'-63'
 Remarks Elevation at top of protective casing = 66.9 ft above NGVD (with cap off)

SAMPLE								
Depth Feet	Type & Number	Blows per 6 in.	Depth Range	Rec.	U.S.C.S.	Strata Change Depth	Sample Description	HNU Response (PPM)
0	SS-1	002/08/06	0-1.5	12"		2'	0-3" Loamy Topsoil, 3"-9" Fine brown SAND some brown silt and gravel	
5	SS-2	035/55/18 (5-5.5' 300# wt)	4.0-5.5	8"		6'	Brown F-C SAND and fine to coarse Gravel, trace silt	
10	SS-3	038/28/25 (9.5'-10.5' 300# wt)	9.0-10.5	10"			Gray Brown fine to coarse SAND and gravel, some silt, trace clay Gray TILL	
15	SS-4	055/ Refusal	14.0-14.5	2"			Boulder 14'8" to 16'4"	
20	SS-5	053/36/29 (300# wt.)	19.0-20.5	16"			Gray TILL	
25	SS-6	023/30/69	24.0-25.5	12"				
30	SS-7	028/42/71 (300 # wt.)	29.0-30.5	16"			Gray TILL	
35	SS-8	024/44/58 (300 # wt.)	34.0-35.5	11"				
40	SS-9	079/50/59 (300 # wt.)	39.0-40.5	14"				

ERT BORING LOG

Project Unifirst Corp. Site Woburn, MA BORING UC-3A Sh 2 of 2

Depth Feet	Type & Number	SAMPLE		Rec.	U.S.C.S.	Strata Change Depth	Sample Description	HNU Response (PPM)
		Blows per 6 in.	Depth Range					
45	SS-10	048/90/ (300 # wt.)	44.0-45.0	11"			Spit spoon hard driving-stopped at 45.0'	
50	SS-11	46/109/106 (300 # wt.)	49.0-50.5	18"				
55	SS-12	047/52/ (300 # wt.)	54.0-55.0	10"		55'	<u>Top of Bedrock</u> Dark gray, fine grained DIORITE with minor pink K-spar; joints 70°-80° to core axis; joint faces fresh, planar smooth Roller bit from 61.5'-61.75'	
60	NX-1		58.0-61.5	3.4'		62'	<u>Bottom of Borehole</u>	
65	NX-2		61.75-62	0"				
70								
75								
80								
85								
90								

ERT BORING LOG

Project Unifirst Corp. Site Woburn, MA BORING UC-3B Sh 1 of 1
 Date Started 4/3/84 Completed 4/4/84 Ground Elevation 66.8
 Total Depth 45' Location MASS. DPW R.O.W. Logged by C. Carleo/J. Lawson
 Casing I.D. PW to 9', HW to 45' Contractor Guild Drilling Co. Inc.
 Equipment Installed: 0-30', 2" sch. 40 PVC riser pipe, 30'-45', 2" sch. 40 PVC 0.010" slotted
screen. Surface seal concrete 0-3', Bentonite seal 3'-27.5' Ottawa Sand Packing 27.5'-45'
 Remarks Elevation at top of protective casing = 67.1 ft above NGVD (with cap off)

SAMPLE							
Depth Feet	Type & Number	Blows per 6 in.	Depth Range	Rec.	U.S.C.S.	Strata Change Depth	HNU Response (PPM)
0							
5							
10							
15							
20							
25							
30							
35							
40							

NO SOIL SAMPLES
COLLECTED

ERT BORING LOG

Project Unifirst Corp. Site Woburn, MA BORING UC-3C Sh 1 of 1
 Date Started 4/4/84 Completed 4/6/84 Ground Elevation 66.9
 Total Depth 25' Location MASS. DPW R.O.W. Logged by C. Carleo/J. Lawson
 Casing I.D. HW to 25' Contractor Guild Drilling Co. Inc.
 Equipment Installed: 0-4.8', 2" sch. 40 PVC riser pipe, 4.8'-24.6' 2" sch. 40 PVC 0.010" slotted
screen. Surface seal concrete 0-3', Bentonite seal 3.35'-4.3', Ottawa Sand Packing 4.3'-24.6'
 Remarks Elevation at top of protective casing = 67.2 ft above NGVD (with cap off)

SAMPLE								
Depth Feet	Type & Number	Blows per 6 in.	Depth Range	Rec.	U.S.C.S.	Strata Change Depth	Sample Description	HNU Response (PPM)
0								
5								
10								
15								
20								
25								
30								
35								
40								

NO SOIL SAMPLES
COLLECTED